International Journal for Innovative Engineering and Management Research

A Peer Revieved Open Access International Journal

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IJIEMR Transactions, online available on 10 th Nov 2021.
Link: https://ijiemr.org/downloads/Volume-10/ISSUE-11

DOI: 10.48047/IJIEMR/V10/I11/04

Title: **EVALUATION OF THE EFFECT OF HEIGHT PARAMETERS ON LANDSCAPE TRANSFORMATION IN MEDIUM ZERAFSHAN LANDSCAPES ON THE BASIS OF MODERN METHODS**

Volume 10, Issue 11, Pages: 18-22

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EVALUATION OF THE EFFECT OF HEIGHT PARAMETERS ON LANDSCAPE TRANSFORMATION IN MEDIUM ZERAFSHAN LANDSCAPES ON THE BASIS OF MODERN METHODS

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ABSTRACT: Landscape and land reclamation activities in the field of ecology and environmental protection, as well as the study of territories utilizing modern means such as aerospace, remote sensing, and geographic information systems, receive special attention around the world. Conducting landscape studies using modern methods necessitates analyzing and assessing their capabilities, recognizing current challenges, and generating scientifically sound solutions. Due to the specificity of regions, priority is given to the study of three-dimensional models of regions, mathematical modeling of geographical events-phenomena, and improvement of mathematical statistics in the study of individual components, in turn, complex dynamic processes occurring in landscape classes and their morphological units, differentiation, and transformation. The topography of the area, which is a crucial component of the landscape, is examined in this article, as well as the interactions between them and their impact on vegetation indices (NDVI).

KEYWORD: landscape, factors, 3D model, slope, aspect, algorithm, correlation, matrix, connections, vegetation indicators (NDVI).

Introduction

Anthropogenic degradation, desertification, land reclamation, soil erosion, degradation, deflation, desertification, and other negative geoenvironmental and natural-geographical processes are all on the rise as a result of the intensive use of landscapes around the world to provide mankind with natural resources. Combating these issues is a major priority for international organizations. In particular, the UN's Agenda for Sustainable Development till 2030 sets targets for "protecting and restoring terrestrial ecosystems, their sustainable use, sustainable forest management, combating desertification, halting land degradation and preventing the loss of biodiversity"[1]. These objectives necessitate the development of irrigated agriculture, as well as a set of landscape and reclamation methods based on data from the territory's system-structural study.

In the country, a variety of actions are being implemented to analyze the natural resource potential of the areas on a scientific basis, improve land reclamation, preserve their

[1]Sustainable Development Agendas 2030 // Electronic access: http://www.uz/undp/org/content/uzbekistan.ru

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cadastre, battle salinization and desertification, and ensure human habitation. The Action Strategy for the Further Development of the Republic of Uzbekistan for 2017-2021 identifies important tasks for "further improvement of irrigated land reclamation, development of reclamation and irrigation facilities"[2]. Targeted research into the structure of natural and artificial landscapes in the Middle Zarafshan Basin, as well as the function of geographical elements in landscape stratification and mapping, is critical in this respect.

Presidential Resolution of the Republic of Uzbekistan on November 27, 2017 "On the State Program for the Development of Irrigation and Improvement of Irrigated Lands in 2018-2019", Presidential Decree on February 7, 2017 " On the Strategy of actions for further development of the Republic of Uzbekistan "and the Presidential Address to the Oliy Majlis of the Republic of Uzbekistan on December 28, 2018 in accordance with the requirements of other normative legal acts this scientific research work serves to a certain extent in the performance of tasks.

Research methods. The study employed methods such as field research, laboratory testing, comparison, cartography, aerospace, mathematical, statistical analysis, simulation, and systematic mapping using geoinformation systems.

The extent to which the problem has been studied. Complex natural geographical studies of the Zarafshan basin were carried out by S. P. Suchkov, L. N. Babushkin, N. A. Kogay, N. A. Gvozdetsky, A. S. Saidov, P. Baratov, L. A. Alibekov, A. A. Abdulkosimov, N. I. Sabitova, A. Rakhmatullaev, A. N. Khojimatov, R.Y. Abdurakhmonova, O.SH.Rozikulova others. Foreign scholars P.A. Burrough [1], G.Eichorn [2], C.Le Bas, M.Jamagne [4], I.Yu.Katorgin and A.A.Kashin were engaged in the study of landscapes by modern methods.

However, the application of current methodologies, such as geo-information systems, aeronautical methods, and probabilistic equations in the mathematical modeling of natural processes, has received little attention in the study of landscapes in the Middle Zarafshan Basin to date. The major goal of this work is to close the gaps mentioned above.

The study results: based on satellite images and a digital model of relief, developed a model and mapping methodology for the effects of erosion processes and hydrographic networks on changes in landscape types; the algorithm for creating a mathematical-cartographic model of foothill plain landscapes on the basis of space images has been improved, and a methodology for using this model in landscape research has been proposed.

Main part. Slope (Fig. 1) and exposure (Fig. 2) were calculated using slope and aspect algorithms representing relief based on a 3Dmodel, which allowed for the analysis of correlation matrices with changes in landscape vegetation, regression statistics, and changes in vegetation and soil cover with landscape component dynamics. [3].

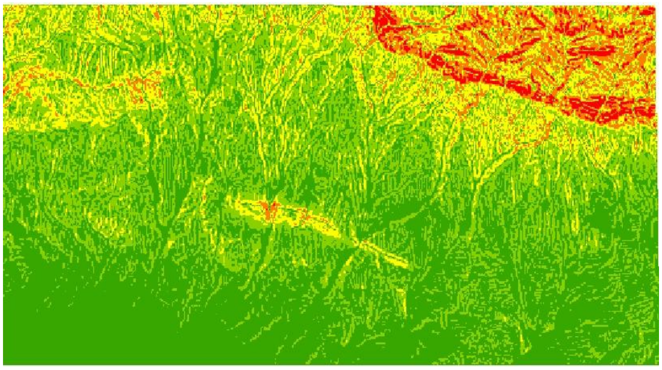

Figure 1. A slope card based on a 3D model

Images obtained in 3 periods after the creation of these maps were additionally placed on it through Create Random Points, combining all the created layers of the base site so that the

[2]Presidential Decree PD-4947 on 7 February 2017 on the Action Strategy for the Further Development of the Republic of Uzbekistan.

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NDVI values are translated into the appearance of three-dimensional models and slope and aspect. On this basis, the extent to which the calculated NDVIs of the base section were related to slope, aspect and height was calculated (figure 3).

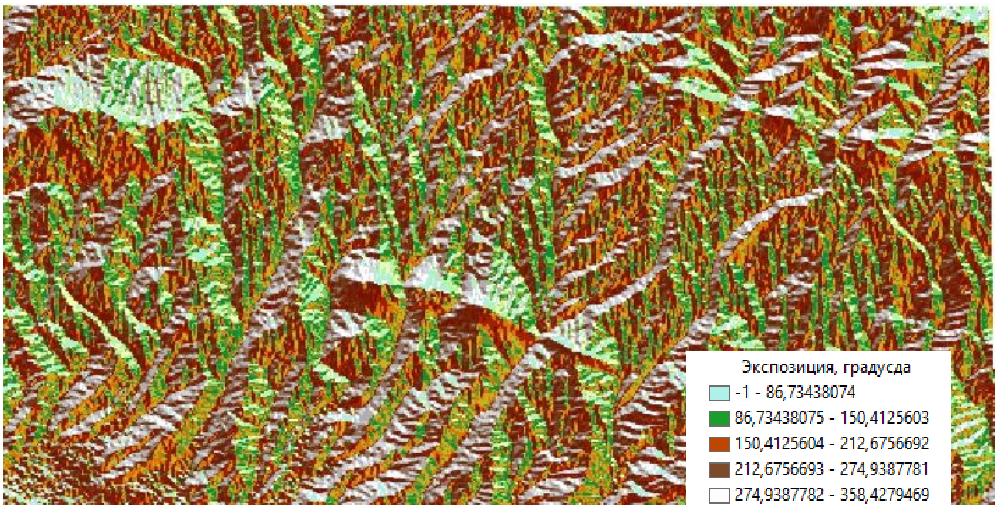

Figure 2. Aspect (exposure) card based on 3D model

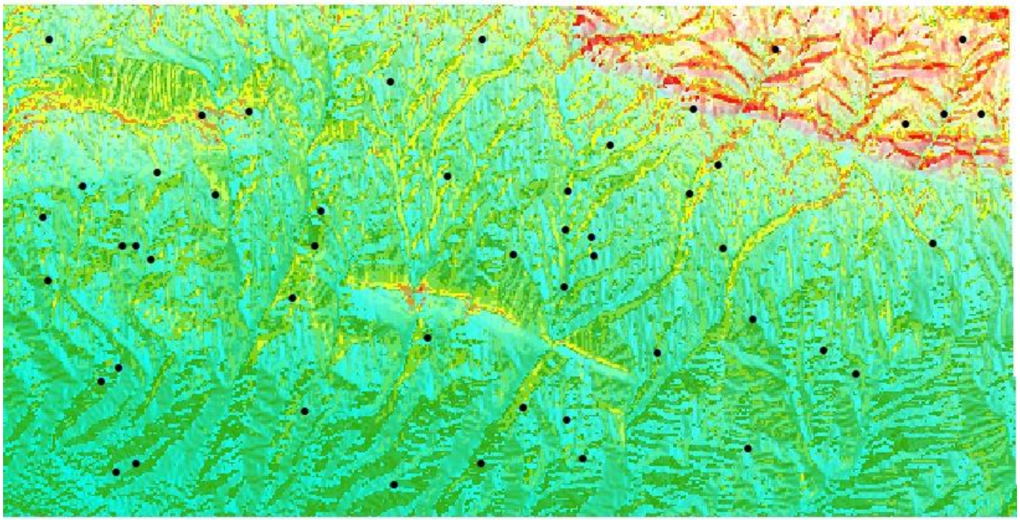

Figure 3. Create Random Point Random Placement Card (Analysis Card).

As a result of combining all the above-mentioned cards and placing 50 points at random on them, the ArcMap program automatically calculates the AttributeTable.

Correlation matrices, regression statistics and graphs can be drawn from this table.

Table 1

General regressive statistics on all factors taken into account

Polynomialvalue R	0,591
R-square	0,350
Normalized R-square	0,276
Defaulterror	0,109
Numberofobservations	50

Table 2

Coordinate sample statistics

coordinates	*Coefficients*	*Defaulterror*	*t-statistics*	*P-value*	*Lessthan 95%*	*More than 95%*
Y-Crossings	11,416381	25,897683	0,440826	0,661497	-40,776970	63,609732
X 1 Variable	0,000371	0,000234	1,589170	0,119183	-0,000100	0,000842
X 2 Variable	-0,010487	0,006003	-1,746785	0,087653	-0,022586	0,001612
X 3 Variable	0,000119	0,000208	0,571191	0,570777	-0,000300	0,000537
X 4 Variable	0,000003	0,000002	1,731164	0,090430	-0,000001	0,000007
X 5 Variable	-0,000003	0,000006	-0,554423	0,582096	-0,000014	0,000008

Table 3
Landscape change in 2017 according to NDVI data correlation matrix

	2017 ndvi	***height***	***slope***	***Exposure***	***Coordinate X***	***CoordinateY***
2017 ndvi	1					
Height	-0,0257	1				
Slope	-0,1345	0,781	1			
Exposure	0,3490	-0,073	-0,121	1		
Coordinate X	0,2242	0,588	0,381	-0,044	1	
Coordinate Y	-0,2367	0,791	0,647	-0,160	0,152	1

We will look at the data in this matrix and attribute table using the following graphs. As only NDVI values were shown in the matrix in 2017, the full correlation of all parameters is not reflected in the matrix. We therefore look at how height, exposure and slope are related to average NDVI values in 2013, 2015 and 2017.

It is clear here that there is a correct and clear correlation of altitude with average NDVI values. I.e, as the height increases, the NDVI values also increase. This means that the vegetation index increases and decreases with height. With the exception of a few anomalous cases (irrigated land) it can be seen that it has the right connection. Crop vegetation indices are based on other methods. As the main area of the base plot is an unirrigated erosion plain, the

algorithm for calculating NDVI of irrigated land has not been implemented. A similar connection can be seen in the right connection when viewed through the exposure.

Here, 19 of the 50 cases correspond to the western slope, 14 cases to the northern slope and the remaining 17 cases to the southern and eastern slopes. From this it can be seen that while the moisture coefficient is high due to the barrier of the western slopes, the NDVI has high values due to the low radiation on the northern slopes.

This graph shows that the slope angle has an inverse connection with the vegetation index.

I.e, as the incline increases, the figure decreases, and vice versa. This is because on large sloping surfaces, erosion is severe and bedrock is exposed. Although the process of soil formation is accelerated, they accumulate in low-lying areas. This results in unfavourable conditions for plant growth.

Conclusion.Individual NDVIs (vegetation indices) were automatically calculated and mapped for each of the satellite images of the baseline area taken from the Landsat space station. This allowed a differential map to be created to determine the dynamics of change over the years.

Maps reflecting the slope and aspect (exposure) of the base area were created. All created layers were then merged and the random points were optimally placed on them using the command line Create Random Points in ArcGIS. On this basis, the degree to which the calculated NDVI of the base section is related to slope, aspect and height can be determined.

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